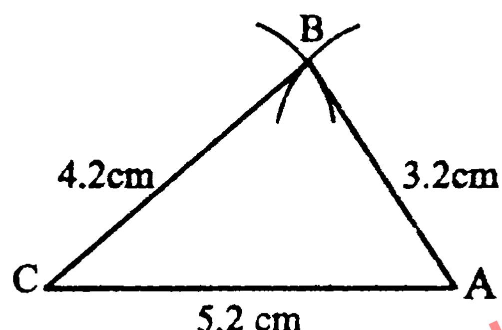
Unit 17
Ratio And Proportion

EXERCISE 17.1

Q1. Construct a ΔABC, in which

(i) $m\overline{AB} = 3.2$ cm, $m\overline{BC} = 4.2$ cm, $m\overline{CA} = 5.2$ cm

Solution:



Construction:

(i) Draw a line segment $m\overline{CA} = 5.2$ cm.

(ii) With centre A and radius equal to 3.2 cm, draw an arc.

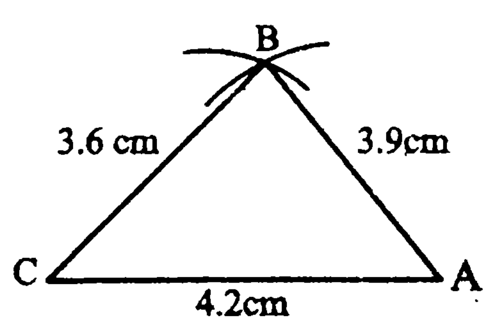
(iii) With center C and radius equal to 4.2 cm, draw another arc to cut the first arc at point B.

(iv) Join BC and AB.

Then ABC is the required triangle.

(ii) $m\overline{AB} = 4.2$ cm, $m\overline{BC} = 4.2$ cm, $\overline{CA} = 3.6$ cm

Solution:



Construction:

(i) Draw a line segment $\overline{AB}$ such that $m\overline{AB} = 4.2$ cm.

(ii) With centre B and radius 3.9 cm draw an arc.

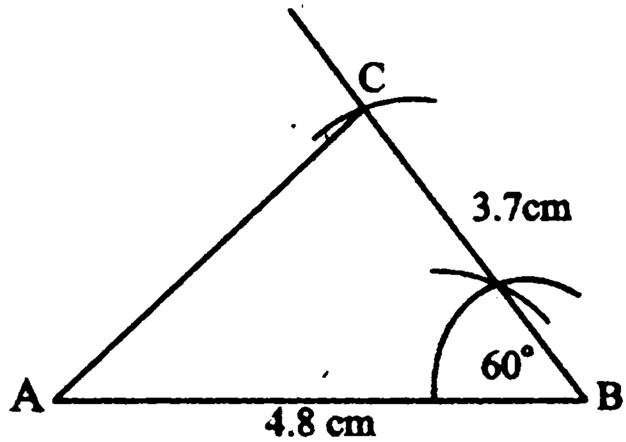
(iii) With centre A and radius 3.6 cm draw another arc to cut the first arc at C.

(iv) Join C to A and B.

ABC is the required angle.

(iii) $m\overline{AB} = 4.8$ **cm,** $m\overline{BC} = 3.7$ **cm,** $m\angle B = 60^\circ$

Solution:



Construction:

(i) Draw a line segment $m\overline{AB} = 4.8$ cm.

(ii) At the end B of $\overline{AB}$ make $m\angle ABC = 60^\circ$.

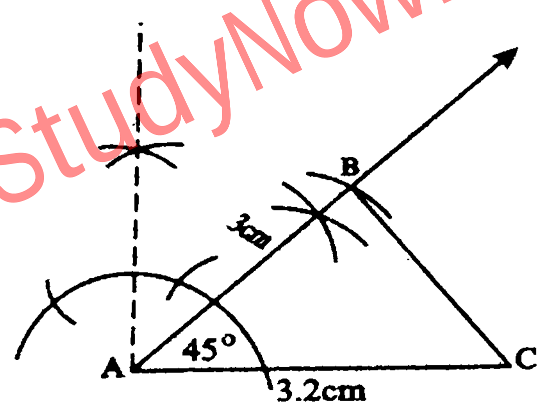
(iii) Cut of $m\overline{BC} = 3.7$ cm.

(iv) Join A to C

ABC is the required angle.

(iv) $m\overline{AB} = 3$ **cm,** $m\overline{AC} = 3.2$ **cm,** $m\angle A = 45^\circ$

Solution:



Construction:

(i) Draw a line segment $m\overline{AC} = 3.2$ cm.

(ii) At the end A of $\overline{AC}$ make $\angle CAB = 45^\circ$.

(iii) Cut off $m\overline{AB} = 3$ cm.

(iv) Join B to C

So ABC is the required triangle.

(v) $m\overline{BC} = 4.2$ **cm,** $m\overline{CA} = 3.5$ **cm,** $m\angle C = 75^\circ$

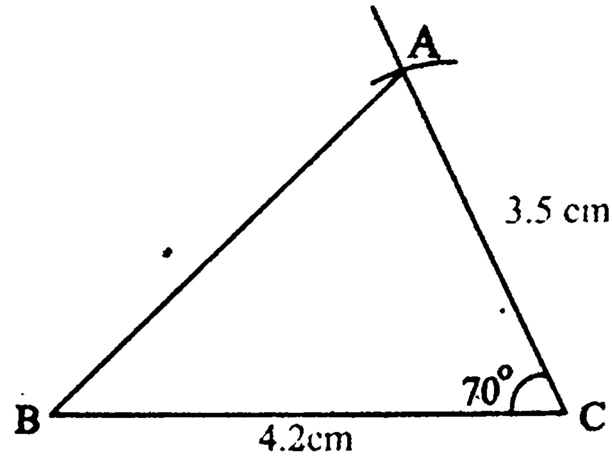
Solution:

Construction:

(i) Draw a line segment $m\overline{BC} = 4.2$ cm.

(ii) At the end C of $\overline{BC}$ make $\angle BCA = 70^\circ$.

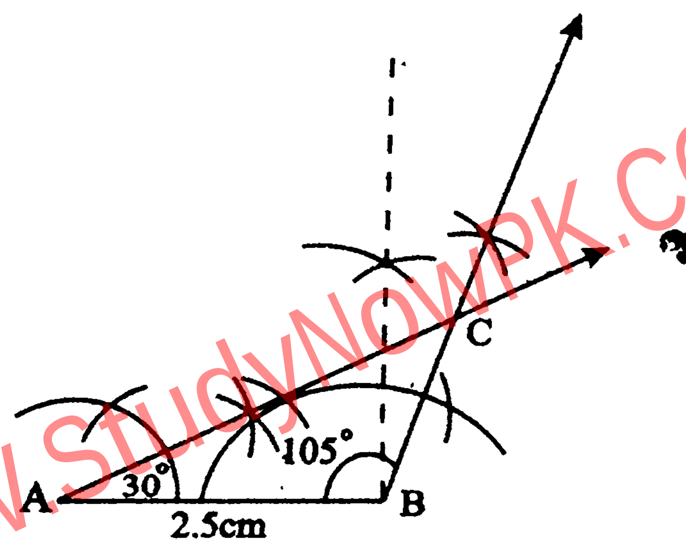
(iii) Cut off $m\overline{CA} = 3.5$ cm.



(iv) Join A to B
So ABC is the required Δ.

(vi) $m\overline{AB}$ = 2.5 cm, m∠ = 30° cm, m∠B = 105°

Solution:



Construction:

(i) Draw a line segment $m\overline{AB}$ = 2.5 cm.

(ii) At the end point A of $\overline{AB}$ make ∠BAC = 30°.

(iii) At the end point B of $\overline{AB}$ make ∠ABC = 105°.

(iv) The terminal sides of these two angles meet at C.
Then ABC is the required triangle.

(vii) $m\overline{AB}$ = 3.6 cm, m∠A = 75°, m∠B = 45°

Solution:

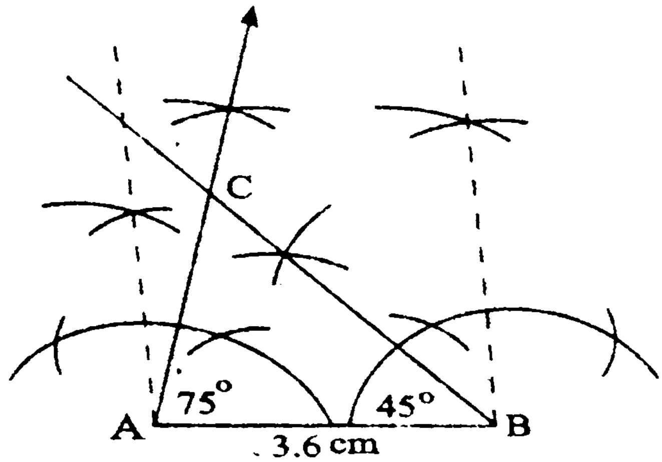
Construction:

(i) Draw a line segment $m\overline{AB}$ = 3 cm.

(ii) At the end point A of $\overline{AB}$ make ∠BAC = 75°.

(iii) At the end poi. B of $\overline{AB}$ make ∠ABC = 45°.

(iv) The terminal sides of these two angles meet at C.

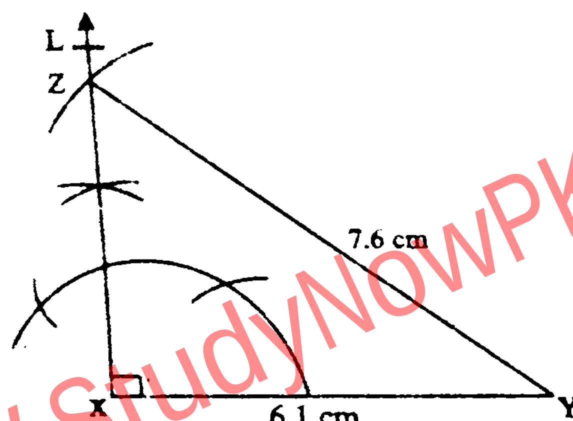


Then ABC is the required Δ.

Q2. Construct a ΔXYZ, in which

(i) $m\overline{YZ}$ = 7.6 cm, $m\overline{XY}$ = 6.1 and m∠X = 90°

Solution:



Construction:

(i) Draw a line segment $m\overline{XY}$ = 6.1 cm.

(ii) At the end point X of $\overline{XY}$ make ∠YXL = 90°.

(iii) With centre Y and radius equal to 7.6 cm draw an arc to cut $\overrightarrow{XL}$ at point Z.

(iv) Join T to Z.

Then XYZ is the required Δ.

(ii) $m\overline{ZX}$ = 6.4 cm, $m\overline{YZ}$ = 2.4 and m∠Y = 90°

Solution:

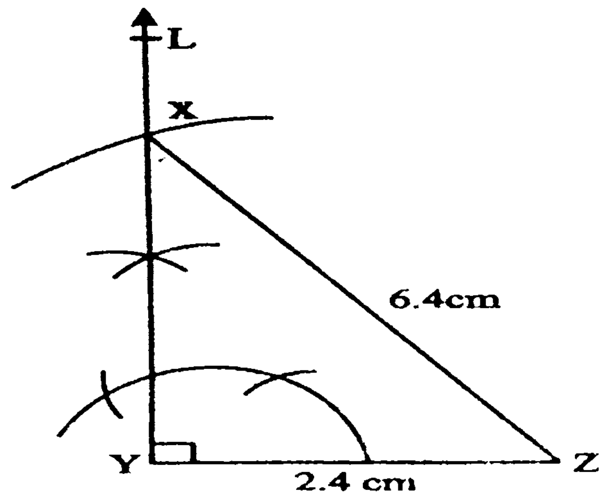
Construction:

(i) Draw a line segment $m\overline{YZ}$ = 2.4 cm.

(ii) At the end point Y of $\overline{YZ}$ make ∠XYZ = 90°.

(iii) With centre Z and radius equal to 6.4 cm draw an arc to cut $\overrightarrow{YL}$ at point X.

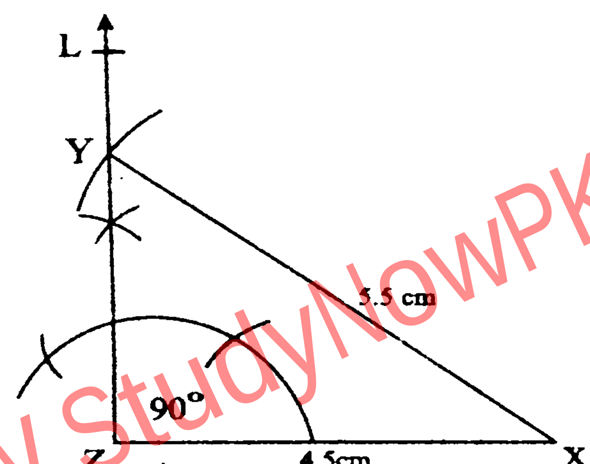
(iv) Join X to Z.



Then XYZ is the required Δ.

(iii) **$m\overline{XY}$ = 5.5 cm, $m\overline{ZX}$ = 4.5 and m∠Z = 90°**

Solution:



Construction:

(i) Draw a line segment $m\overline{ZX}$ = 4.5 cm.

(ii) At the end point Z of $\overline{ZX}$ make ∠XZL = 90°.

(iii) With centre X and radius equal to 5.5 cm draw an arc to cut $\overrightarrow{ZL}$ at point Y.

(iv) Join Y to X.

Then the required triangle is ΔXYZ.

Q3. **Construct a right-angled Δ measure of whose hypotenuse is 5 cm and one side is 3.2 cm. (Hint: Angle in a semi-circle is a right angle).**

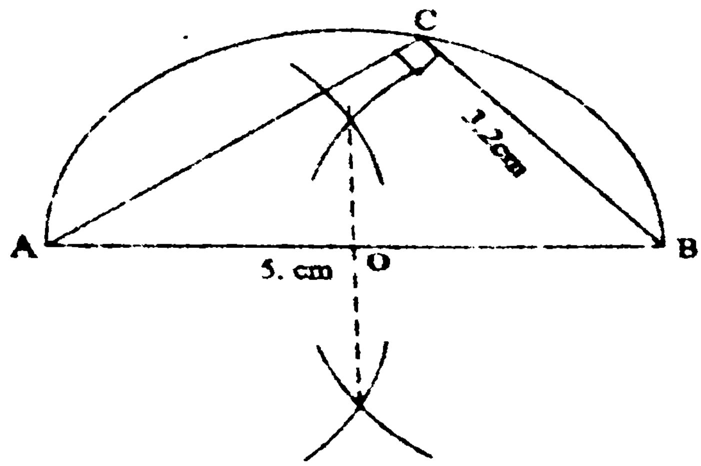
Solution:

Construction:

(i) Draw a line segment $m\overline{AB}$ = 5.2 cm.

(ii) Find the mid-point O of $\overline{AB}$.

(iii) With centre at O and radius equal to $\overline{OA}$ draw and semi circle.



(iv) Join C to A and B.
Then ABC is the required triangle.

Q4. Construct a right-angled isosceles triangle whose hypotenuse is

(i) 5.2 cm long

Solution:

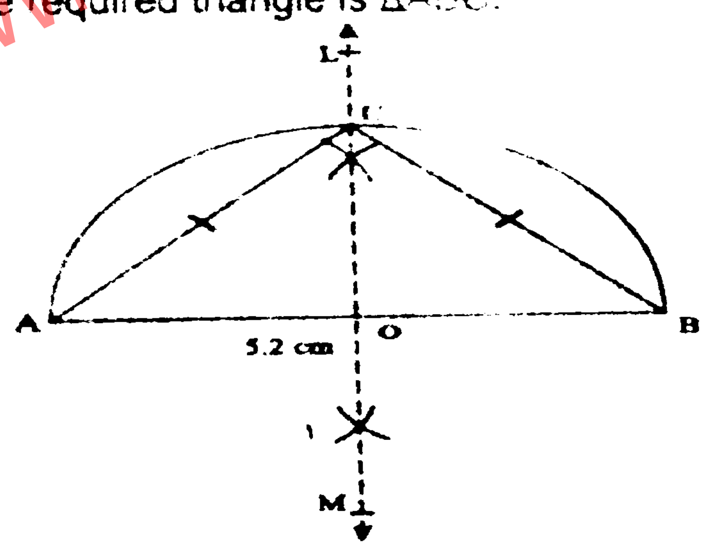
Construction:

(i) Draw a line segment $m\overline{AB}$ = 5 cm

(ii) Draw $\overleftrightarrow{LM}$ the right bisector of $\overline{AB}$ cutting it at the point O.

(iii) With centre at the point O and $\overline{AB}$ as diameter draw a semi-circle to cut $\overleftrightarrow{LM}$ at the point C.

(iv) Join C to A and B.
So the required triangle is ΔABC.



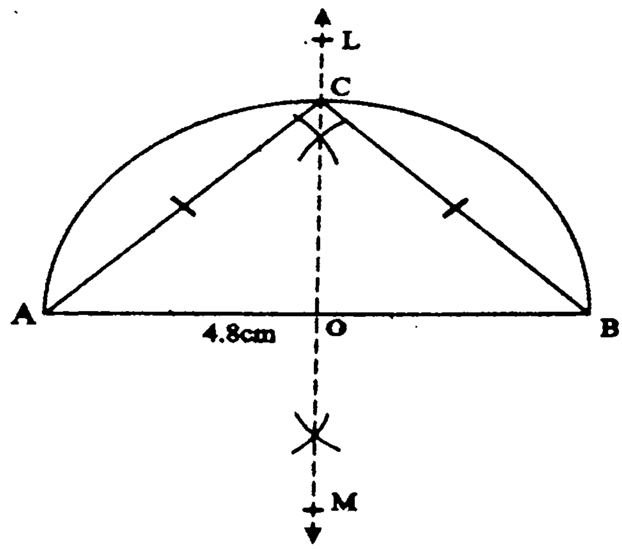
(ii) 4.8 cm

Solution:

Construction:

(i) Draw a line segment $m\overline{AB}$ = 4.8 cm.

(ii) Draw $\overleftrightarrow{LM}$ the right bisector of $\overline{AB}$ cutting it at the point O.



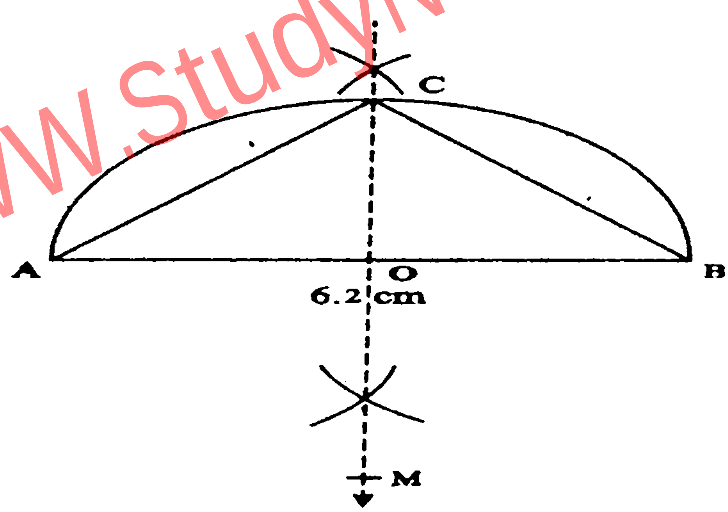
(iii) With O as centre and $\overline{AB}$ as diameter draw a semi-circle to cut $\overleftrightarrow{LM}$ at the point C.

(iv) Join C to A and B.

Then the required triangle is ABC.

(iii) 6.2 cm

Solution:



Construction:

(i) Draw a line segment $m\overline{AB} = 6.2$ cm.

(ii) Draw $\overleftrightarrow{LM}$ the right bisector of $\overline{AB}$ cutting it at the point O.

(iii) With centre at the point O $\overline{AB}$ as diameter, draw a semi-circle to cut $\overleftrightarrow{LM}$ at the point C.

(iv) Join C to A and B.

Then the required triangle is ABC.

(iv) 5.4 cm

Solution:

Construction:

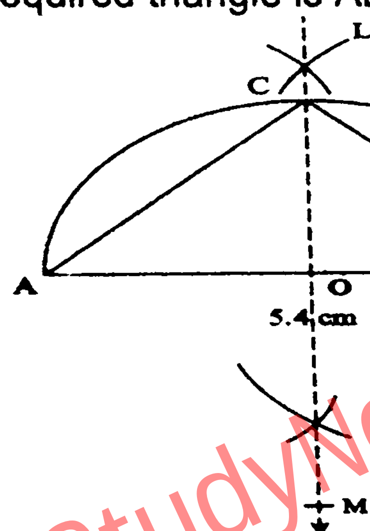
(i) Draw a line segment $m\overline{AB} = 5.4$ cm.

(ii) Draw $\overleftrightarrow{LM}$ the right bisector of $\overline{AB}$ cutting it at the point O.

(iii) With centre at the point O and $\overline{AB}$ as diameter, draw a semi-circle to cut $\overleftrightarrow{LM}$ at the point C.

(iv) Join C to A and B.

So the required triangle is ABC.

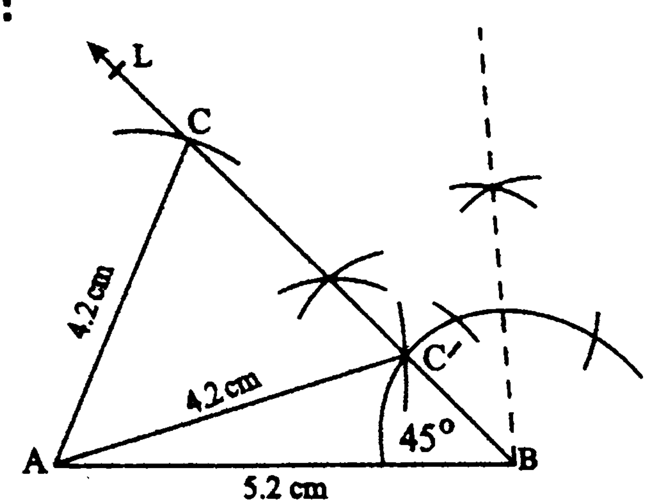


Q5. (Ambiguous Case) Construct at ΔABC in which

(i) $m\overline{AC} = 4.2$ cm, $m\overline{AB} = 5.2$ cm, $m\angle B = 45°$ (two Δs)

Solution:

Construction:



(i) Draw a line segment $m\overline{AB} = 5.2$ cm.

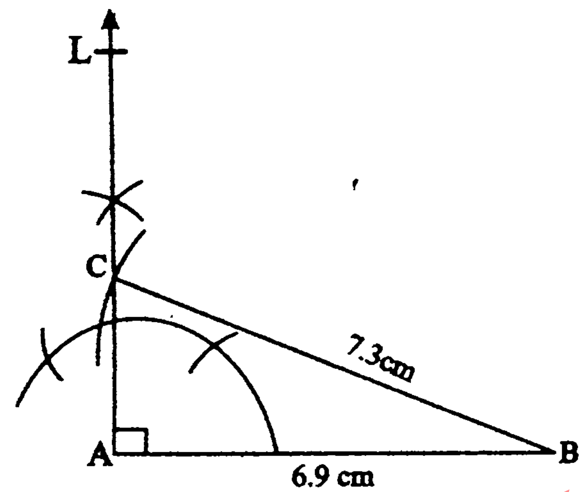
(ii) At the end point B make $m\angle ABL = 45°$

(iii) With centre at A and radius 4.2 cm, draw an arc to cut $\overline{BL}$ at two points C and C'.

(iv) Join A to C and C'.
So ΔABC and $\angle ABC'$ are two required triangles.

(ii) $m\overline{AB} = 6.9$ cm, $m\overline{BC} = 7.3$ cm, $m\angle A = 90°$ (one Δ)

Solution:



Construction:

(i) Draw a line segment $m\overline{AB} = 5.2$ cm.

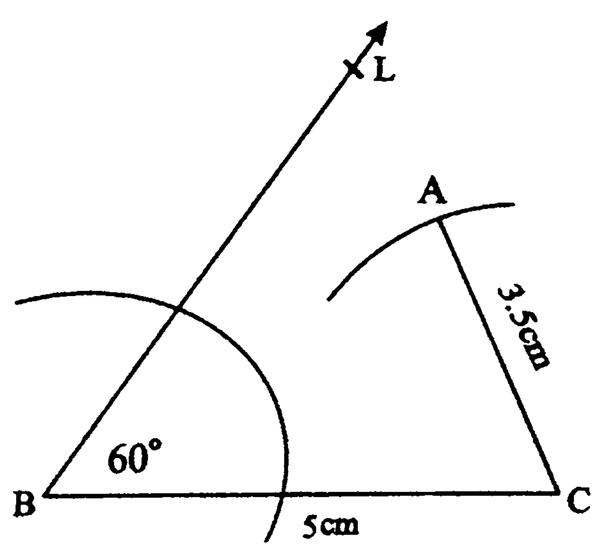
(ii) At the end point A make $m\angle BAL = 90°$

(iii) With centre at B and radius 7.3 cm, draw an arc to cut $\overline{AL}$ at the end point C.

(iv) Join A to C.
Then ΔABC is the required triangles.

(iii) $m\overline{BC} = 5$ cm, $m\overline{CA} = 3.5$ cm, $m\angle B = 60°$

Solution:



Construction:

(i) Draw a line segment $m\overline{BC} = 5$ cm.

(ii) At the end point B make $m\angle CBL = 60°$

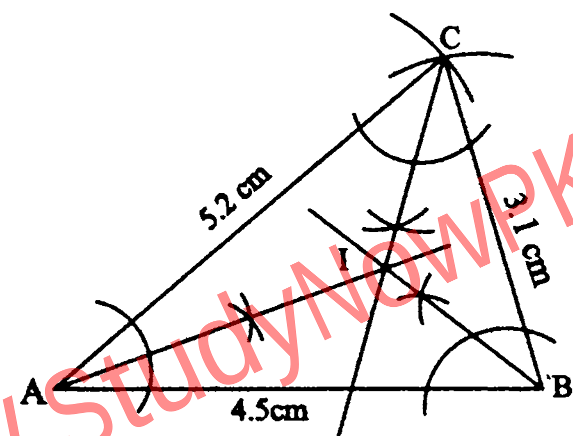
(iii) With centre at the point C and radius 3.5 cm draw an arc.
It does not cut $\overline{BL}$.
So we cannot construct a triangle with the given data.

EXERCISE 17.2

Q1. Construct the following Δ's ABC. Draw the bisectors of their angles and verify their concurrency.

(i) $m\overline{AB} = 4.5$ cm, $m\overline{BC} = 3.1$ cm, $m\overline{AC} = 5.2$ cm

Solution:

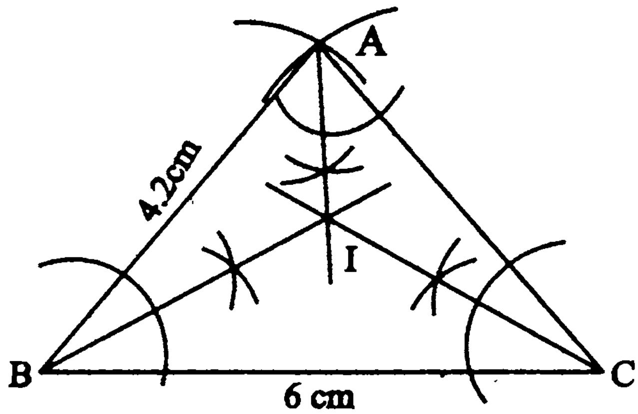


Construction:

(i) Take $m\overline{AB} = 4.5$ cm.
(ii) With B as centre and radius $m\overline{BC} = 3.1$ cm draw an arc.
(iii) With centre A and radius $m\overline{AC} = 5.2$ cm draw another arc which intersects the first arc at C.
(iv) Join $\overline{CA}$ and $\overline{CB}$ to complete the ΔABC.
(v) Draw bisectors of ∠B and ∠C meeting each other at the point I.
(vi) Now draw the bisector of the third ∠A.
(vii) We observe that the third angle bisector also passes through the point I.
(viii) Hence the angle bisectors of the ΔABC are concurrent at I.

(ii) $m\overline{BC} = 6$ **cm,** $m\overline{AB} = 4.2$ **cm,** $m\overline{CA} = 5.2$ **cm.**

Solution:



Construction:

(i) Take $m\overline{BC} = 6$ cm.

(ii) With B as centre and radius $m\overline{BA} = 4.2$ cm draw an arc.

(iii) With C as centre and radius $m\overline{CA} = 5.2$ cm draw another arc which intersects the first arc at A.

(iv) Join $\overline{BA}$ and $\overline{CA}$ to complete the ΔABC.

(v) Draw bisectors of $\angle B$ and $\angle C$ meeting each other at the point I.

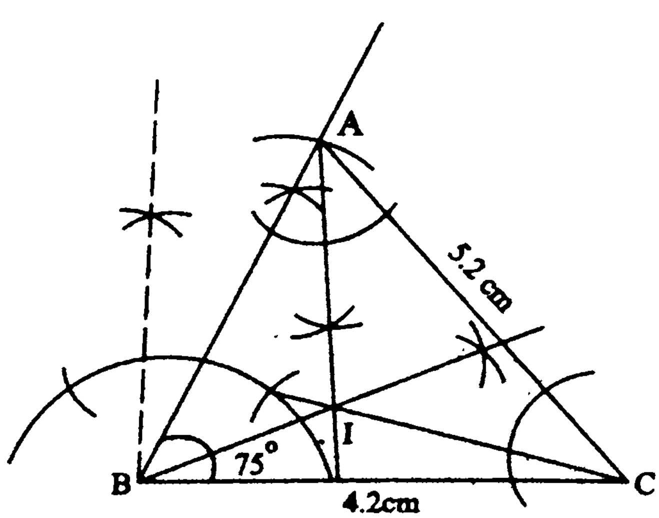
(vi) Now draw the bisector of the third $\angle A$.

(vii) We observe that the third angle bisector also passes through the point I.

(viii) Hence the angle bisectors of the ΔABC are concurrent at I.

(iii) $m\overline{AB} = 3.6$ **cm,** $m\overline{BC} = 4.2$ **cm,** $m\overline{CA} = 5.2$ **cm.**

Solution:



Construction:

(i) Take $m\overline{BC} = 4.2$ cm.

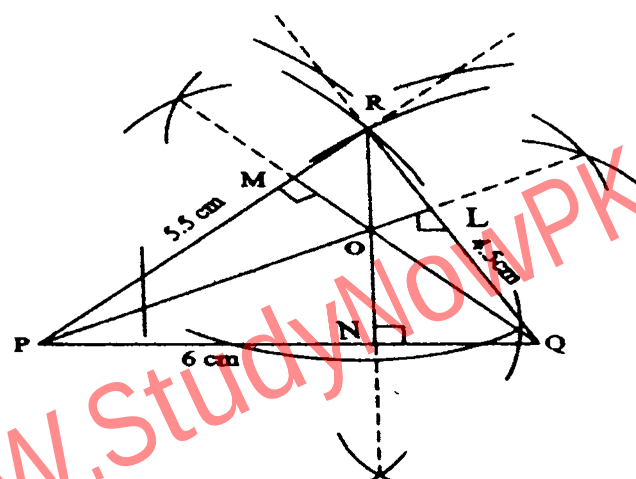
(ii) With B as centre and radius $m\overline{BA} = 3.6$ cm draw an arc.

(iii) With C as centre and radius $m\overline{CA} = 5.2$ cm draw an arc.
(iv) Join $\overline{BA}$ and $\overline{CA}$ to complete the ΔABC.
(v) Draw bisectors of $\angle B$ and $\angle C$ meeting each other at the point I.
(vi) Now draw the bisector of the third $\angle A$.
(vii) We observe that the third angle bisector also passes through the point I.
(viii) Hence the angle bisectors of the ΔABC are concurrent at I.

Q.2. Construct the following $\Delta's$ PQR. Draw their altitudes and show that they are concurrent.

(i) $m\overline{PQ} = 6$ cm, $m\overline{QR} = 4.5$ cm, $m\overline{PR} = 5.5$

Solution:



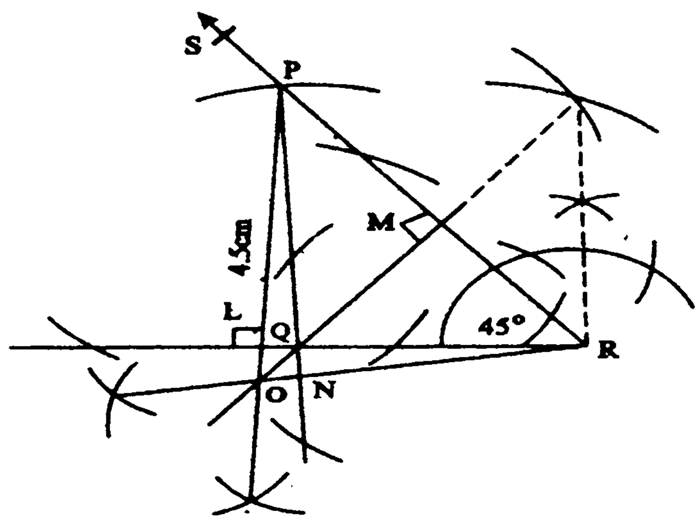
Construction:

(i) Take $m\overline{PQ} = 6$ cm.
(ii) With P as centre and radius equal to 5.5 cm draw an arc.
(iii) With Q as centre and radius equal to 4.5 cm draw another arc to cut the first arc at R.
(iv) Join $\overline{PR}$ and $\overline{QR}$ to complete the triangle ΔPQR.
(v) From the vertex P draw $\overline{PL} \perp \overline{QR}$.
(vi) From the vertex Q draw $\overline{QM} \perp \overline{PR}$. These two altitudes meet in the point O inside the ΔPQR.
(vii) Now from the third vertex 'R' draw $\overline{RN} \perp \overline{PQ}$.
(viii) We observe that this third altitude also passes through the point of intersection O of the first two altitudes.

(viii) Hence the three altitudes of the ΔPQR are concurrent at O.

(ii) $m\overline{PQ} = 4.5$ **cm,** $m\overline{QR} = 3.9$ **cm,** $m\angle R = 45°$

Solution:



Construction:

(i) Take $m\overline{QR} = 3.9$ cm.

(ii) At point R make $m\angle QRS = 45°$.

(iii) With centre at Q radius 4.5 cm draw an arc to cut $\overrightarrow{RS}$ at the point P.

(iv) Join P to Q to complete the ΔPQR.

(v) From the vertex P drop $\overline{PL} \perp \overline{RQ}$ produced.

(vi) From the vertex Q drop $\overline{QM} \perp \overline{PR}$. These two altitudes meet in the point O inside the ΔPQR.

(vii) Now from the third vertex R, drop $\overline{RN} \perp \overline{PQ}$ produced.

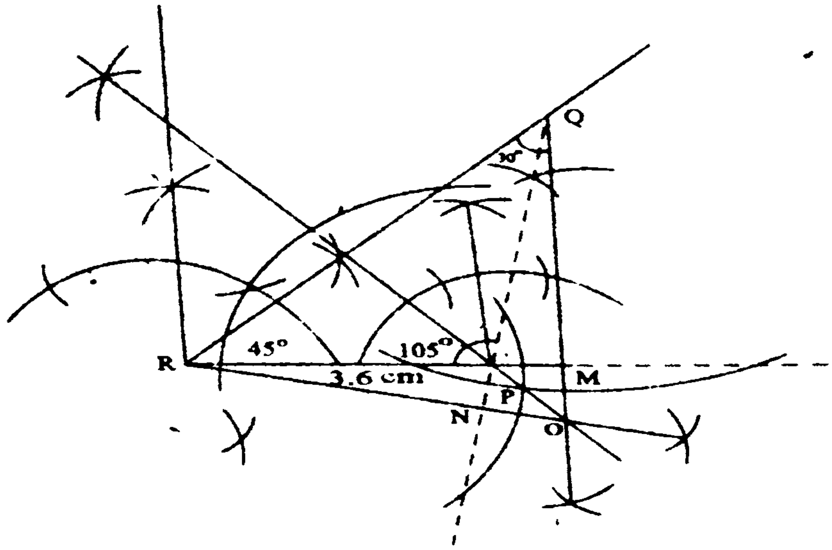
(viii) We observe that this third altitude also passes through the point of intersection O of the first two altitudes.

Hence the three altitudes of the ΔPQR are concurrent at O.

(iii) $m\overline{RP} = 3.6$ **cm,** $m\angle Q = 30°$, $m\angle P = 105°$

Solution:

$$m\angle Q = 30°, m\angle P = 105°$$
$$m\angle P + m\angle Q + m\angle R = 180°$$
$$105° + 30° + m\angle R = 180°$$
$$m\angle R = 180° - 135 = 45°$$



Construction:

(i) Take $m\overline{RP} = 3.6$ cm.

(ii) Draw $m\angle QRS = 45°$ and $m\angle RPQ = 105°$ to complete ΔPQR.

(iii) From the vertex P drop $\overline{PL} \perp \overline{QR}$.

(iv) From the vertex Q drop $\overline{QM} \perp \overline{RP}$ produced. These two altitudes meet at the point O.

(v) Now from the third vertex R drop $\overline{RN} \perp \overline{QP}$ produced.

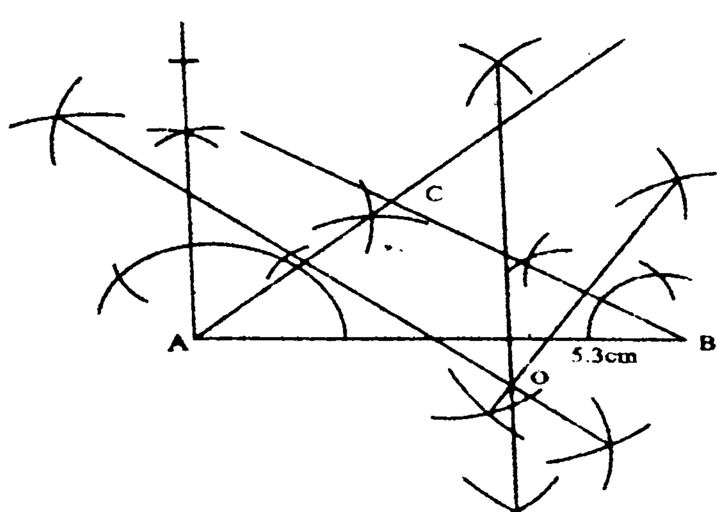
(vi) We observe that the third altitude also passes through the point of intersection O of the first two altitudes.

(vii) Hence the three altitudes of ΔPQR are concurrent at O.

Q3. Construct the following triangles ABC. Draw the perpendicular bisectors of their sides and verify their concurrency. Do you meet inside the triangle?

(i) $m\overline{AB} = 5.3$ cm, $m\angle A = 45°$, $m\angle B = 30°$

Solution:



Construction:

(i) Take $m\overline{AB} = 5.3$ cm.

(ii) At the point A make $m\angle BAC = 45°$.

(iii) At the point B make $m\angle ABC = 30°$.

(iv) The terminal sides of these angles meet at C and ABC is the required triangle.

(v) Draw perpendicular bisectors of $\overline{BC}$ and $\overline{CA}$ meeting each other at the point O.

(vi) Now draw the perpendicular bisector of third side $\overline{AB}$.

(vii) We observe that it also passes through O, the point of intersection of first two perpendicular bisectors.

(vii) Hence the three perpendicular bisectors of sides of ΔABC are concurrent at O.

(ii) $\mathbf{m\overline{BC} = 2.9}$ **cm,** $\mathbf{m\angle A = 30°, m\angle B = 60°}$

Solution:

$$m\angle A = 30°, \qquad m\angle B = 60°$$

$$\therefore \qquad m\angle C = 180° - 30° - 60° = 90°$$

Construction:

(i) Take $m\overline{BC} = 2.9$ cm.

(ii) At the point B make $m\angle ABC = 60°$.

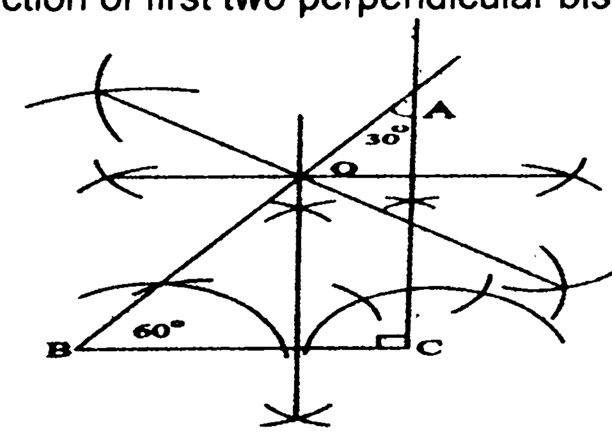
(iii) At the point C make $m\angle ACB = 90°$.

(iv) The terminal sides of the two angles meet at A and we get the required triangle ΔABC.

(v) Draw perpendicular bisectors of $\overline{BC}$ and $\overline{CA}$ meeting each other at the point O.

(vi) Now draw the perpendicular bisector of third side $\overline{AB}$.

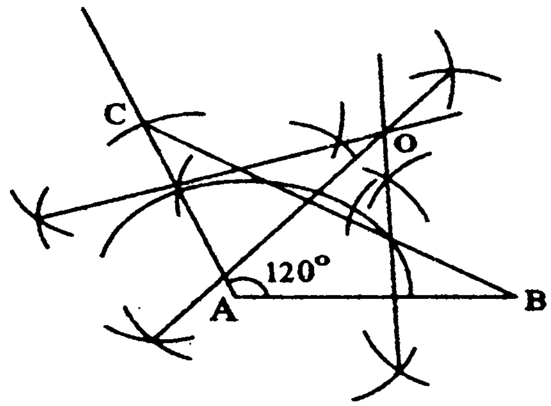
(vii) We observe that it also passes through O, the point of intersection of first two perpendicular bisectors.



(vii) Hence the three perpendicular bisectors of ΔABC are concurrent at O.

(iii) $\quad m\overline{AB} = 2.4$ **cm,** $m\overline{CA} = 3.2$ **cm,** $m\angle A = 120°$

Solution:



Construction:

(i) Take $m\overline{AB} = 2.4$ cm.

(ii) At the end point A make $m\angle BAC = 120°$.

(iii) With centre at the point A and radius 3.2 cm cut $m\overline{CA} = 3.2$ cm.

(iv) Join B to C to complete the triangle ABC.

(v) Draw perpendicular bisectors of $\overline{BC}$ and $\overline{CA}$ meeting each other at the point O.

(vi) Now draw the perpendicular bisector of third side $\overline{AB}$.

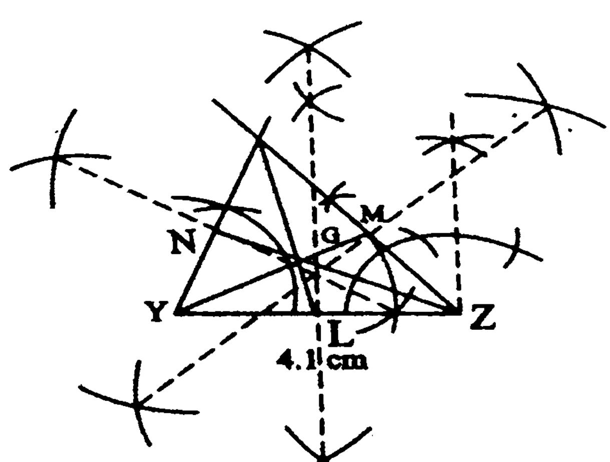
(vii) We observe that it also passes through O, the point of intersection of first two perpendicular bisectors.

(vii) Hence the three perpendicular bisectors of ΔABC are concurrent at O.

Q4. Construct the following Δ's XYZ. Draw their three medians and show that they are concurrent?

(i) $\quad m\overline{YZ} = 4.1$ **cm,** $m\angle X = 75°$**,** $m\angle Y = 60°$

Solution:



$m\angle X = 75°$, $m\angle Y = 60°$

So $\quad m\angle Z = 180° - 135° = 45°$

Construction:

(i) Take $m\overline{YZ} = 4.1$ cm.

(ii) At the point Y make $m\angle XYZ = 60°$.

(iii) At the point Z make $m\angle XYZ = 45°$.

(iv) The terminal sides of the two angles meet at X and we get the ΔXYZ.

(v) Draw perpendicular bisectors of the sides $\overline{XY}$, $\overline{YZ}$ and $\overline{XZ}$ of the ΔXYZ and mark their mid points L, M and N respectively.

(vi) Join X to L to get the median $\overline{XL}$.

(vii) Join Y to M to get the median $\overline{YM}$.

(viii) The medians $\overline{XL}$ and $\overline{YM}$ meet in the point G.

(ix) Now draw the third median $\overline{ZN}$.

(x) We observe that the third median also passes through the point of intersection of first two medians.

(xi) Hence the three medians of the ΔXYZ pass through the same point G i.e. they are concurrent at the point G.

(ii) **$m\overline{XY} = 4.5$ cm, $m\overline{YZ} = 3.4$ cm, $m\overline{ZX} = 5.6$**

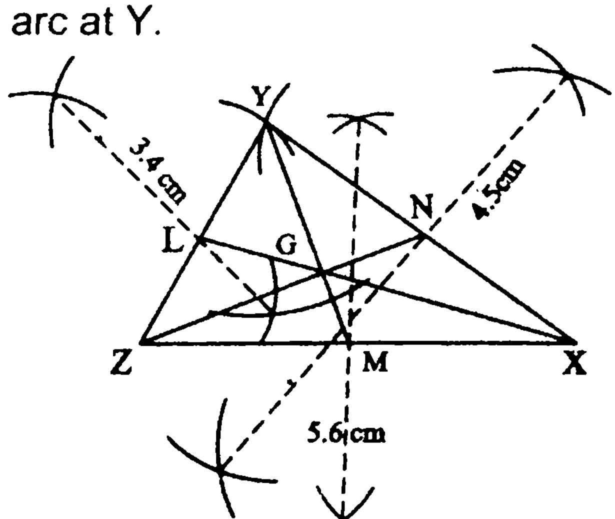
Solution:

Construction:

(i) Take $m\overline{ZX} = 5.6$ cm.

(ii) With centre Z and radius $m\overline{ZY} = 3.4$ cm draw an arc.

(iii) With centre X and radius $m\overline{XY} = 4.5$ cm which intersects the first arc at Y.



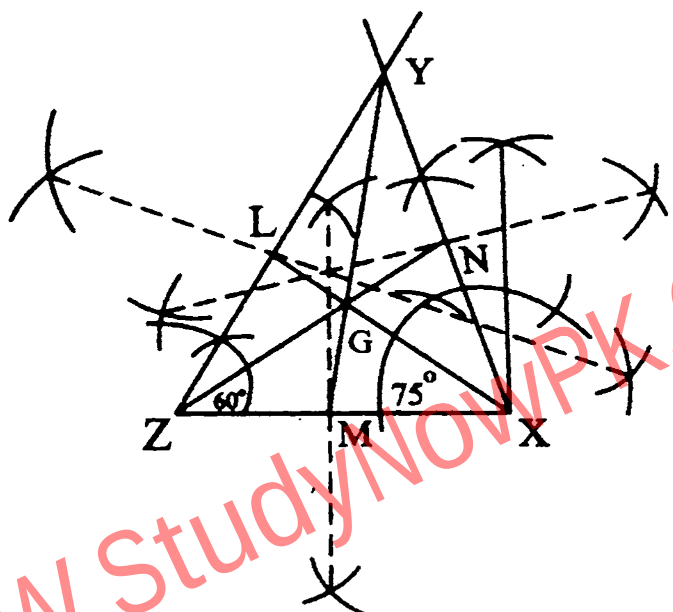
(iv) Join $\overline{ZY}$ and $\overline{XY}$ to get the ΔXYZ.

(v) Draw the perpendicular bisectors of the sides $\overline{XY}$, $\overline{YZ}$ and $\overline{ZX}$ of the ΔXYZ and mark their mid points L, M and N respectively.

(vi) Join X to mid point L to get the median $\overline{XL}$.
(vii) Join Y to mid point M to get the median $\overline{YM}$.
(viii) The medians $\overline{XL}$ and $\overline{YM}$ meet in the point G.
(ix) Now draw the third median $\overline{ZN}$.
(x) We observe that the third median also passes through the point of intersection G of first two medians.
(xi) Hence the three medians of the ΔXYZ pass through the same point G. That is, they are concurrent at G.

(iii) $m\overline{XY} = 4.5$ cm, $m\overline{YZ} = 3.4$ cm, $m\overline{ZX} = 5.6$ cm

Solution:



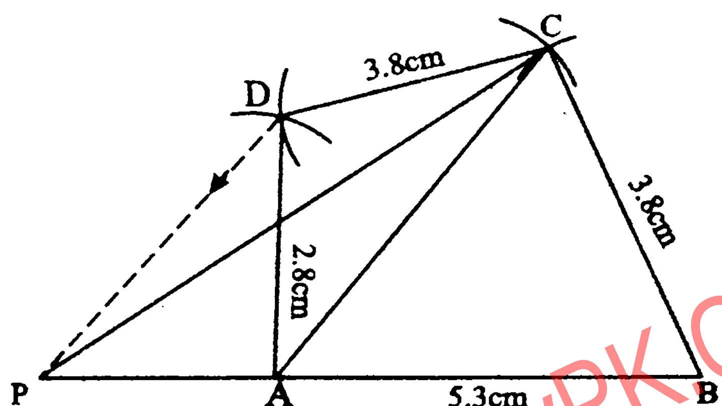
Construction:
(i) Take $m\overline{ZX} = 5.6$ cm.
(ii) At the end point Z make $m\angle XYZ = 60°$.
(iii) At the end point X make $m\angle YXZ = 75°$.
(iv) The terminal sides of the two angles meet at Y and we get the ΔXYZ.
(v) Draw perpendicular bisectors of the sides $\overline{YZ}$, $\overline{ZX}$ and $\overline{XY}$ of the ΔXYZ and mark their mid points L, M and N respectively.
(vi) Join X to mid point L to get the median $\overline{XL}$.
(vii) Join Y to mid point M to have the median $\overline{YM}$.
(viii) The medians $\overline{XL}$ and $\overline{YM}$ meet in the point G.
(ix) Now draw the third median $\overline{ZN}$.
(x) We observe that the third median also passes through the point of intersection G of first two medians.

(xi) Hence the three medians of the ΔXYZ pass through the same point G. That is, they are concurrent at G.

EXERCISE 17.3

Q1. Construct a quadrilateral ABCD, having $m\overline{AB} = m\overline{AC} = 5.3\ cm, m\overline{BC} = m\overline{CD} = 3.8\ cm$ and $m\overline{AD} = 2.8\ cm$.

Solution:



Construction:

(i) With centre at A and B radius 5.3 cm draw an arc.
(ii) Take $m\overline{AB}$=5.3 cm.
(iii) With centre at B and radius 3.8 cm draw another arc to cut the first arc at D.
(iv) Join $\overline{BC}$ and $\overline{AC}$.
(v) With centre at C and radius 3.8 cm draw an arc.
(vi) With centre at A and radius 2.8 c draw another arc to cut the first arc at D.
(vii) Join $\overline{AD}$ and $\overline{DC}$ to complete the quadrilateral ABCD.
(viii) Through D draw ∥ CA meeting BA produced at P.
(ix) Join PC.
(x) The ΔPBC is the required triangle.

Q2. Construct a Δ equal in area to the quadrilateral PQRS, having $m\overline{QR} = 7\ cm$, $m\overline{RS} = 6\ cm$, $m\overline{SP} = 2.75\ cm$, $m\angle QRS = 60^o$ [Hint: $2.75 = \frac{1}{2} \times 5.5$]

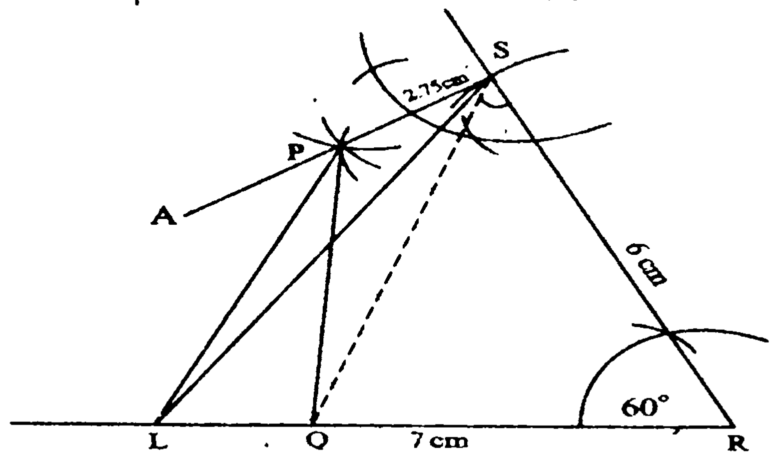
Solution:

Construction:

(i) Take $m\overline{QR} = 7\ cm$.
(ii) At the point R make $m\angle QRS = 60^o$

(iii) With centre at R cut off $\overline{RS} = 6\ cm$

(iv) At the end point S make $\angle RSA = 90^{o}$



(v) From SA cut off $m\overline{SP} = 2.75\ cm$

(vi) Join $\overline{PQ}$ to complete the quadrilateral PQRS.

(vii) Join $\overline{QS}$

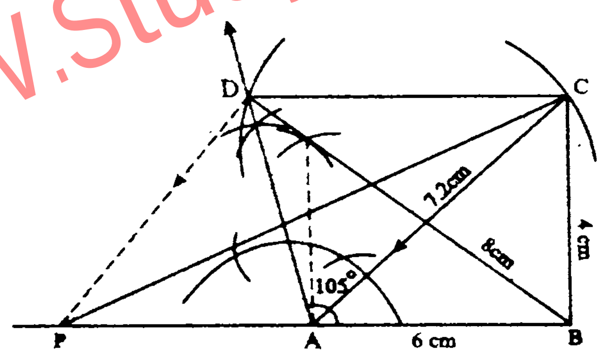
(viii) Through P draw $PL \parallel QS$ to meet RQ produced at L.

(ix) Join $\overline{SL}$

(x) Then LRS is the required triangle

Q3. **Construct a Δ equal in area to the quadrilateral ABCD, having $m\overline{AB} = 6cm$, $m\overline{BC} = 4cm$, $m\overline{AC} = 7.2\ cm$, $m\angle BAD = 105^{o}$ and $m\overline{BD} = 8cm$.**

Solution:



Construction:

(i) Take $m\overline{AB} = 6cm.$

(ii) With centre at the end point A and radius 7.2 cm draw an arc.

(iii) With B as centre and radius 4 cm draw another arc to cut AL at the point D.

(iv) Join $\overline{AC}$ and $\overline{BC}$.

(v) At the end point A make $m\angle BAL = 105^{o}$

(vi) With B as centre and radius 8 cm draw arc to cut AL at the point D.

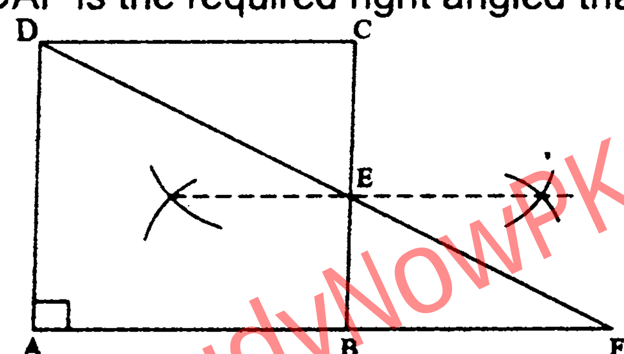
(vii) Join DC to complete the quadrilateral ABCD.
(viii) Draw $\overline{DP} \parallel \overline{CA}$ to meet BA produced at P.
(ix) Join P to C.
(x) Then PBC is the required triangle.

Q4. Construct a right-angled triangle equal in area to a given square.

Solution:

Construction:

(i) Draw perpendicular bisector of $\overline{BC}$.
(ii) Mark point E the mid point of $\overline{BC}$.
(iii) Draw the straight line DEF to meet AB produced the point F.
(iv) Then DAF is the required right angled triangle.



Note:

Right angled triangles DCE and FBE are congruent because $m\overline{CE} = m\overline{BE}$ *and* $m\angle CED = m\angle BEF$.

So area ΔDAF

$= area\ quadrilateral\ ABED + area\ \Delta FBE.$
$= area\ quadrilateral\ ABED + area\ \Delta ECD$
$= area\ square\ ABCD.$

EXERCISE 17.4

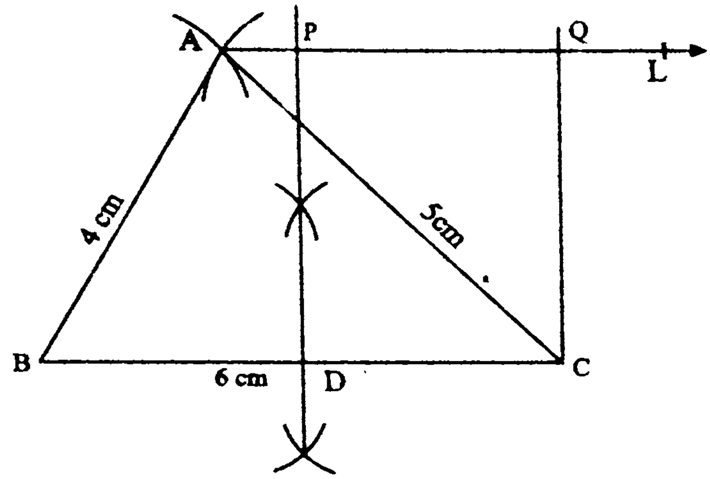
Q1. Construct a Δ with sides 4 cm, 5 cm and 6 cm and construct a rectangle having its area equal to that of the Δ. Measure its diagonals. Are they equal?

Solution:

Construction:

(i) Draw a line segment $m\overline{BC} = 6\ cm.$

(ii) With centre at the point B and radius as 4 cm draw an arc.



(iii) With centre at the point C with radius 5 cm draw w another arc cut the first arc at the point A.

(iv) Join $\overline{AB}$ and $\overline{AC}$ to complete the ΔABC.

(v) Bisect $\overline{BC}$at P.

(vi) Draw $\overrightarrow{AL} \parallel \overline{BC}$.

(vii) Draw perpendicular $\overline{DP}$ to meet AL at P.

(viii) Cut off $\overline{PQ} = \overline{DC}$

(ix) Join Q to C.

Then PQCD is the required rectangle. Measure the diagonal $\overline{DQ} = 4.5\ cm$

Q2. Transform isosceles Δ into rectangle.

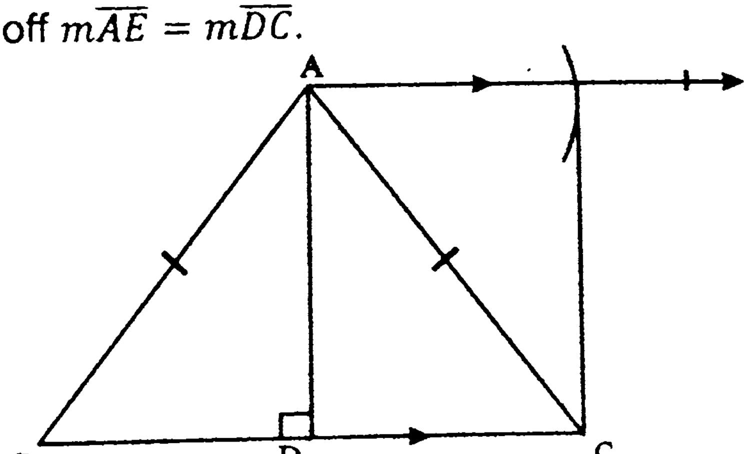
Solution:

Construction:

(i) Draw $\overline{AD} \perp \overline{BC}$.

(ii) Draw $\overline{AE} \parallel \overline{DC}$.

(iii) Cut off $m\overline{AE} = m\overline{DC}$.

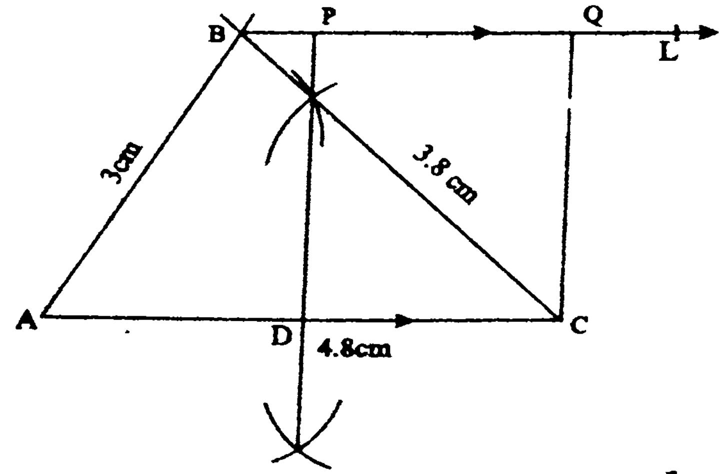


(iv) Join $\overline{EC}$.

Then ADCE is the required rectangle.

Q3. Construct ΔABC such that $m\overline{AB} = 3cm$, $m\overline{BC} = 3.8\,cm, m\overline{AC} = 4.8\,cm$.
Construct a rectangle equal in area to the ΔABC, and measure its sides.

Solution:



Construction:

(i) Draw a line segment $m\overline{AC} = 4.8\,cm$.
(ii) With centre at A and radius 3 cm draw an arc.
(iii) With centre at C and radius 3.8 cm draw another arc to cut the first arc at B.
(iv) Join $\overline{AB}$ and $\overline{BC}$ to complete the ΔABC.
(v) Draw $\overrightarrow{BL} \parallel \overline{AC}$.
(vi) Draw $\overline{DP}$ the perpendicular bisector of $\overline{AC}$ to meet $\overline{BL}$ at P.
(vii) Cut off $m\overline{PQ} = m\overline{DC}$.
(viii) Join Q to C.
(ix) Then PQCD is the required rectangle.
(x) Measure the sides of the rectangle, $m\overline{DC} = 2.4\,cm$ and $m\overline{DP} = 2.3\,cm$

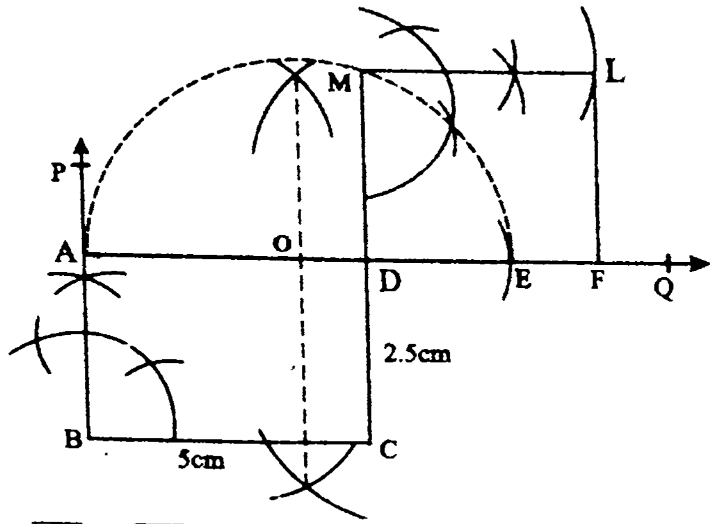
EXERCISE 17.5

Q1. Construct a rectangle whose adjacent sides are 2.5 cm and 5 cm respectively. Construct a square having area equal to the given rectangle.

Solution:

Construction:

(i) Draw a line segment $m\overline{BC} = 5cm$.



(ii) Draw $\overline{BP} \perp \overline{BC}$
(iii) Cut off $m\overline{BA} = 2.5\ cm$
(iv) Cut off $m\overline{DE} = m\overline{DC}$.
(v) Produce $\overline{AD}$ to Q.
(vi) Cut off $m\overline{DE} = m\overline{DC}$.
(vii) Bisect $\overline{AE}$ at the point O.
(viii) With O as the centre and $m\overline{OA}$ as radius draw semi circle.
(ix) Produce $\overline{CD}$ to meet the semi circle at M.
(x) With $m\overline{DM}$ as a side complete the square DFLM.
(ix) Then DFLM is the required square.

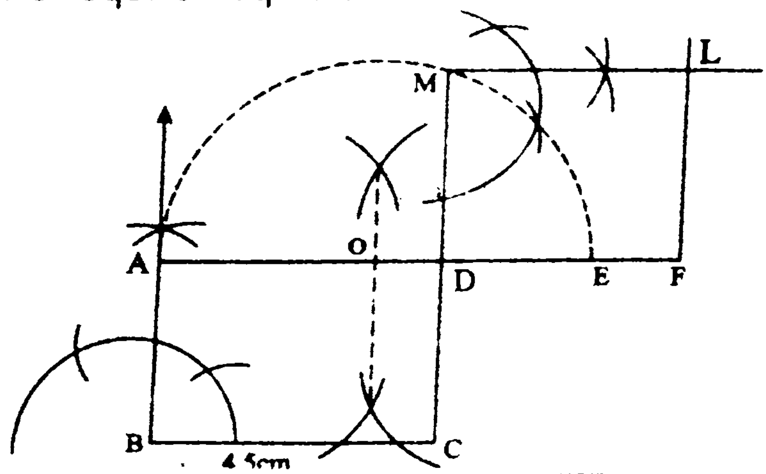
Q2. Construct a square equal in area to a rectangle whose adjacent sides are 4.5 cm and 2.2 cm respectively. Measure the sides of the square and find its area and compare with the area of the rectangle.

Solution:

Construction:

(i) Take $m\overline{BC} = 4.5\ cm$
(ii) At the end point B draw $\overrightarrow{BP} \perp BC$.
(iii) Cut off $m\overline{BA} = 2.2\ cm$
(iv) Complete the rectangle ABCD.
(v) Produce $\overline{AD}$ to E making $m\overline{DE} = m\overline{CD}$.
(vi) Bisect $\overline{AE}$ at O.
(vii) With centre O and radius $m\overline{OA}$ describe a semi circle.
(viii) Produce $\overline{CD}$ to meet the semi-circle in M.

(ix) On $\overline{DM}$ as a side construct a square DFLM. This shall be the required square.



(x) Measure the side of the square. $m\overline{DF} = 3.2\ cm.$

$Area\ of\ square = 3.2 \times 3.2 = 10.24\ cm^2(approx).$

$Area\ of\ reactangle = 4.5 \times 2.2 = 9.90\ cm^2(approx).$

Q3. In Q2 above verify by measurement that the perimeter of the square is less than that of the rectangle.

Solution:

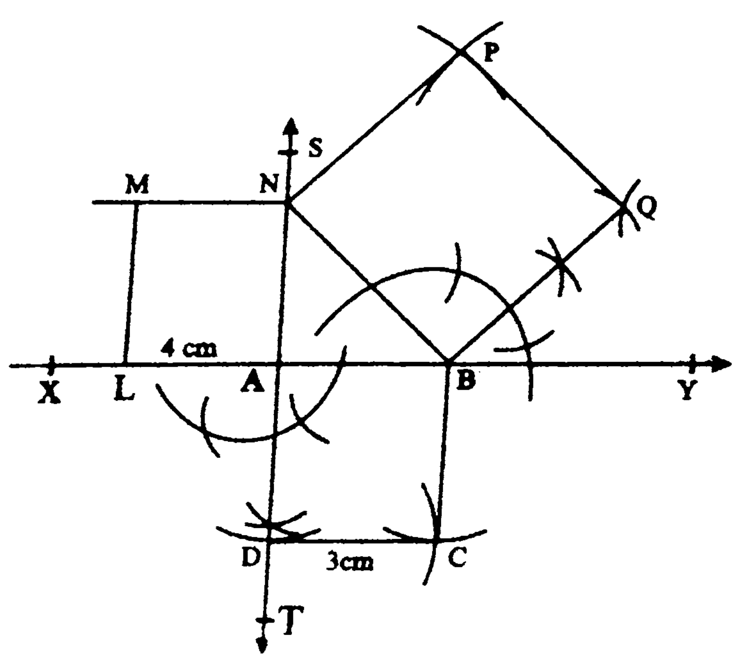
$Perimeter\ of\ square = 4 \times 3.2 = 12.8\ cm$

$Perimeter\ of\ reactangle = 2(4.5 + 2.2) = 2(6.7) = 13.4$

$So\ perimeter\ of\ square\ is\ less\ than\ that\ of\ reactangle.$

Q4. Construct a square equal in area to the sum of two squares having sides 3 cm and 4 cm respectively.

Solution:



Construction:

(i) Through a point A, draw two lines $\overrightarrow{XY}$ and $\overrightarrow{ST}$ perpendicular to each other.

(ii) Cut off $m\overline{AB} = 3cm$ and $m\overline{AL} = 4cm$.

(iii) $\overline{AB}$ as a side of square complete the square ALMN.

(iv) $\overline{AL}$ as a side of square complete the square ALMN.

(v) Join $\overline{BN}$

(vi) With $\overline{BN}$ as a side, complete the square BQPN. BQPN is the required square.

Q5. Construct a Δ having base 3.5 cm and other two sides equal to 3.4 cm and 3.8 cm respectively. Transform it into an equal square.

Solution:

Construction:

(i) Take $m\overline{BC} = 3.5\ cm$.

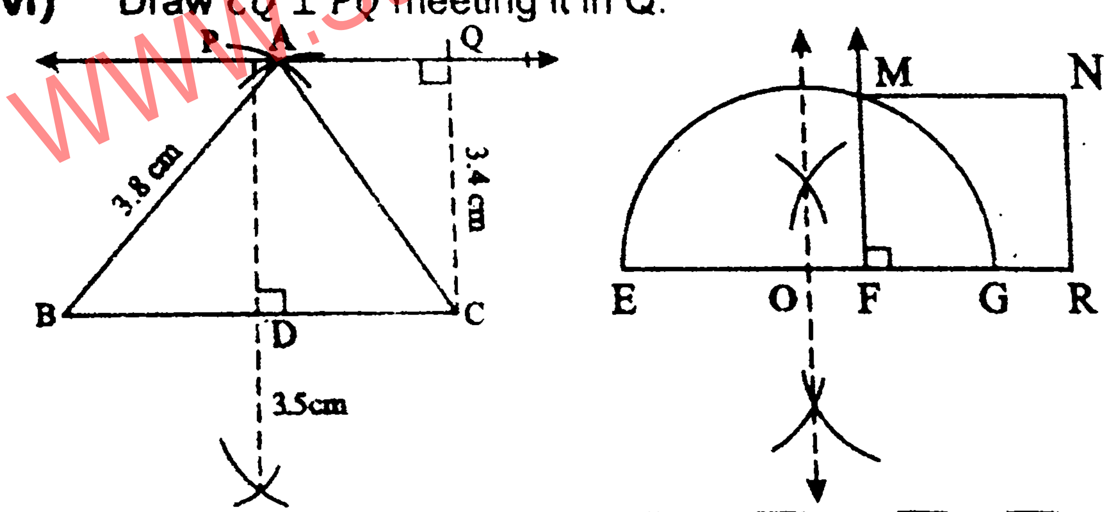
(ii) With B as centre draw an arc of radius 3.8 cm and with C as centre and radius 3.4 cm draw another arc to meet the first are at C.

(iii) Join A to B and A to C to complete the ΔABC.

(iv) Draw $PAQ \parallel \overline{BC}$.

(v) Draw $\overline{CQ} \perp \overline{PQ}$ meeting it in Q.

(vi) Draw $\overline{CQ} \perp \overline{PQ}$ meeting it in Q.



(vii) Take a line EFG and cut off $\overline{EF} = \overline{DP}$ and $\overline{FG} = \overline{DC}$

(ix) With $\overline{MF}$ as a side complete the square FMNR. Then FMNR is required square.

Q6. Construct a Δ having base 5 cm and other sides equal to 5 cm and 6 cm. Construct a square equal in area to given Δ.

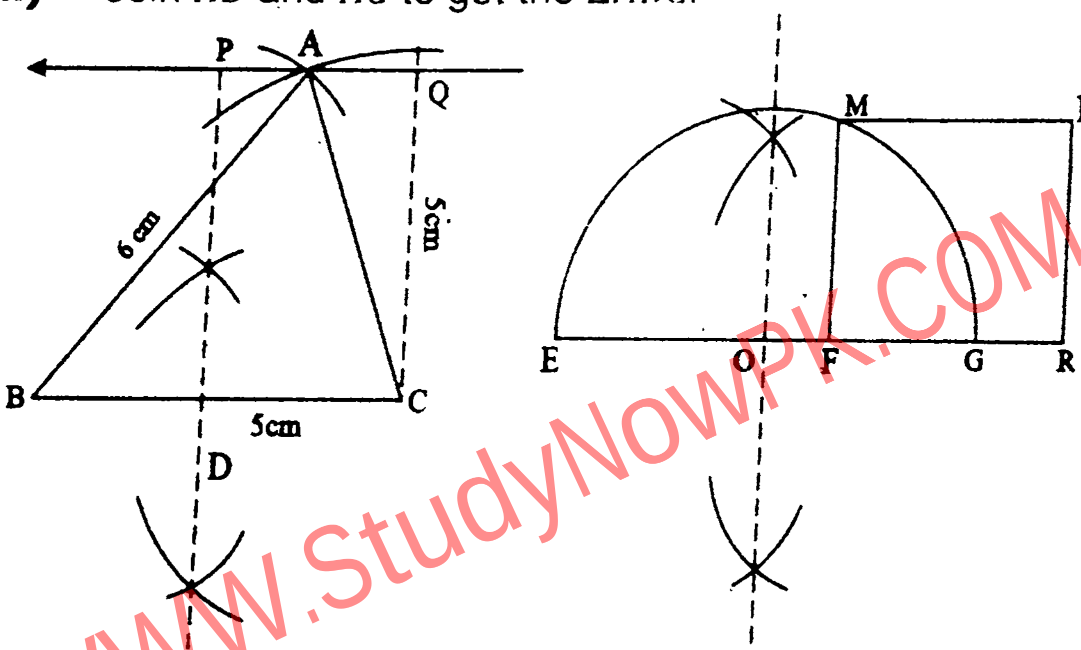
Solution:

Construction:

(i) Take $m\overline{BC} = 5cm$

(ii) With B is centre and radius 6 cm, draw an arc. With centre at C and radius 5 cm draw another arc to cut the first at A.

(iii) Join $\overline{AB}$ and $\overline{AC}$ to get the ΔABC.



(iv) Draw $\overrightarrow{PQ} \parallel \overline{BC}$.

(v) Draw perpendicular bisector of $\overline{BC}$, bisecting it at D and meeting PAQ at P.

(vi) Draw $\overline{CQ} \perp \overline{PQ}$ meeting in Q.

(viii) Take a line EFG and cut off $\overline{EF} = \overline{DP}$ and $\overline{FG} = \overline{DC}$.

(ix) With O as centre and radius $m\overline{OE}$ draw a semi-circle.

(x) At F draw $\overline{FM} \perp \overline{EG}$, meeting the semi-circle at M.

(xi) With $\overline{MF}$ as a side complete required square FMNR.

REVIEW EXERCISE 17

Q1. Fill in the following blanks to make the statement true:

(i) The side of a right angled triangle opposite to 90° is called......

(ii) The line segment joining a vertex of a triangle to the mid-point of its opposite side is called a......

(iii) A line drawn from a vertex of a triangle which is ...... to its opposite side is called an altitude of the triangle.

(iv) The bisectors of the three angles of a triangle are......

(v) The point of concurrency of the right bisectors of the three sides of the triangle is......from its vertices.

(vi) Two or more triangles are said to be similar if they are equiangular and measures of their corresponding sides are.......

(vii) The altitudes of a right triangle are concurrent at the......of the right angle.

Answers:

(i)	**hypotenuse**	**(ii)**	**median**
(iii)	**perpendicular**	**(iv)**	**concurrent**
(v)	**equidistant**	**(vi)**	**proportional**
(vii)	**vertex**		

Q2. Multiple Choice Questions. Choose the correct answer.

(i) A triangle having two sides congruent is called......

(a) scalene (b) right angled
(c) equilateral (d) isosceles

(ii) A quadrilateral having each angle equal to 90° is called......

(a) parallelogram (b) rectangle
(c) trapezium (d) rhombus

(iii) The right bisectors of the three sides of a triangle are......

(a) congruent (b) collinear
(c) concurrent (d) parallel

(iv) The......altitudes of an isosceles triangle are congruent.

(a) two (b) three
(c) four (d) none

(v) A point equidistant from the end points of a line-segment is on its......

(a) bisector (b) right-bisector

(c) perpendicular (d) median

(vi) ....congruent triangles can be made by joining the mid-points of the sides of a triangle.

(a) three (b) four
(c) five (d) two

(vii) The diagonals of a parallelogram......each other.

(a) bisect (b) trisect
(c) bisect at right angle (d) none of these

(viii) The medians of a triangle cut each other in the ratio......

(a) 4 : 1 (b) 3 : 1
(c) 2:1 (d) 1:1

(ix) One angle on the base of an isosceles triangle is 30°. What is the measure of its vertical angle.......

(a) 30° (b) 60°
(c) 90° (d) 120°

(x) If the three altitudes of a triangle are congruent, then the triangle is......

(a) equilateral (b) right angled
(c) isosceles (d) acute angled

(xi) It two medians of a triangle are congruent then the triangle will be......

(a) isosceles (b) equilateral
(c) right angled (d) acute angled

Answers:

(i) d	**(ii) b**	**(iii) c**	**(iv) a**	**(v) b**
(vi) b	**(vii) a**	**(viii) c**	**(ix) d**	**(x) a**
(xi) a				

Q3. Define the following

Solution:

(i) Incentre

The internal bisectors of the angle of a triangle meet at a point called the incentre of the triangle.

(ii) Circumcentre

The point of concurrency of the three perpendicular bisectors of the sides of a Δ is called the circumcentre of the Δ.

(iii) Orthocentre

The point of concurrency of three altitudes of a Δ is called its orthocentre.

(iv) Centroid

The point where the three medians of a Δ meet is called the centroid of the triangle.

(v) Point of concurrency

Three or more than three lines are said to be concurrent, if they all pass through the same point.

The common point is called point of concurrency of the point of concurrency of the lines.